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Efficiency and Performance Evaluation of European Cooperative Banks

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Efficiency and Performance Evaluation of European Cooperative Banks

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Abstract

Cooperative banks play an important role in the European banking system. This paper presents an evaluation of the efficiency and performance of a European cooperative banks. For this purpose an integrated approach is employed using both data envelopment analysis as well as a multicriteria evaluation methodology. Through data envelopment analysis the efficiency of the banks is evaluated under both the profit and the intermediation approach, while controlling for the effect of different country characteristics. The multicriteria evaluation process enables the comparison of all banks in a common setting. The data set involves banks from Germany, France, Italy, Spain, and Austria over the period 2005–2010.

Keywords: Cooperative banks, Efficiency analysis, Data envelopment analysis, Multicriteria decision aid

1 Introduction

Cooperative banks emerged during the 19th and 20th century to address important market imperfections and meet the needs of a broad public basis for access to loans and financing (Fonteyne, 2007). Since then, cooperative banks have undergone significant changes. Today they provide savings products and loans to consumers and small and medium-sized enterprises, but they have also evolved to include investment products in their portfolio of activities. Despite that, cooperative banks are still well-distinguished in terms of their operating model from other types of banks and they have attracted considerable interest on their own from researchers, practitioners, and policy makers.

That should be of no surprise given the size of the cooperative banking sector, at least in the case of Europe. According to statistics from the European Association of Cooperative Banks,[1] there are about 4,000 local cooperative banks in Europe, with 50 million members, serving more than 176 million customers, and with an average market share of 20%. Thus, it is clearly evident that cooperative banks constitute a major part of the European banking sector and they add significantly to Europe's development, competitiveness, and employment policies.

Even though the economic turmoil is not over yet, preliminary studies indicate that cooperative banks responded well to the credit crisis. According to Groeneveld (2011), the direct losses and write-offs of European cooperative banks as a consequence of the credit crisis account for 8% of the total, which is much lower compared to the market share of cooperative banks. Boonstra (2010) emphasizes that no European cooperative bank has failed nor has been nationalized during the credit crisis and attributes most of the losses that cooperative banks faced to their international activities, which are similar to commercial banks. However, Boonstra also notes that cooperative banks may be more severely affected by an economic downturn (as opposed to the manageable losses due to the credit crisis), due to their strong ties to local economies.

Except for such studies, which explore the impact of the crisis on cooperative banks, a significant part of the literature has focused on the differences between cooperative banks and other banking institutions. Some country-specific studies have been presented by Altunbas et al. (2001) for Germany, Bos and Kool (2006) for Netherlands, and Hasan and Lozano-Vivas (2002) for Spain, whereas Girardone et al. (2009) and Kontolaimou and Tsekouras (2010) presented results for samples involving multiple European countries. These studies as well as others (some additional references are given in Goddard et al., 2007) consider the

[1] http://www.eurocoopbanks.coop

comparison of cooperative to non-cooperative banks from different efficiency perspectives (e.g., profit, cost, productive, etc.). However, the existing empirical results fail to provide clear-cut evidences on whether commercial banks outperform cooperative banks.

In contrast to the vast majority of existing studies, this paper is not concerned with the comparison of cooperative to commercial banks. Instead, we focus on analyzing the efficiency and performance of European cooperative banks (from five major European countries) using the most up-to-date data covering the period before the credit crisis and up to 2010. On the methodological side, the analysis is performed in two stages. First, data envelopment analysis (DEA) is employed for analyzing the efficiency of the banks. The efficiency analysis is performed under two popular settings in bank efficiency measurement, namely the profit and the intermediation approach. However, performing comparisons with respect to different countries on the basis of efficiency scores is troublesome.[2] In addition, the efficiency analysis results do not provide a direct way of comparing and ranking all banks, which is very useful for benchmarking and monitoring purposes. Thus, in a second stage, a multicriteria evaluation procedure is employed to analyze the performance of all banks in a common setting based on widely used financial ratios. Multicriteria techniques have been successfully employed for bank performance evaluation (see Doumpos and Zopounidis (2010) and the references therein) but not in the context of cooperative banks. The results of the empirical analysis in this paper provide several interesting findings on the effect of the crisis on the efficiency and performance of the banks in each country, the differences between the profit and the intermediation approaches for analyzing cooperative banks, their connections of efficiency analysis results with a multicriteria evaluation procedure, and the indicators that best describe the performance of the cooperative banks in Europe.

The rest of the paper is organized as follows. Section 2 provides an overview of the methodological approaches used for analyzing the efficiency and performance of cooperative banks in this study. Section 3 presents the setting of the empirical analysis (data and variables), as well as the results from the application of DEA and the multicriteria evaluation procedure. Finally, section 4 concludes the paper and discusses some future research directions.

2 Methodology

2.1 Data Envelopment Analysis Models

Data envelopment analysis (DEA) is a popular methodology for the estimation of the efficiency of decision making units (DMUs, e.g., banks), based on the inputs that each unit uses and the outputs that it produces (Cooper et al., 2007).

In particular, assume that there are data on K inputs and M outputs for N DMUs. For the ith DMU these are represented by the vectors $\mathbf{x}_i$ and $\mathbf{y}_i$, respectively. The $K \times N$ input matrix $\mathbf{X}$, and the $M \times N$ output matrix $\mathbf{Y}$, represent the data for all DMUs. Then, the efficiency of the ith DMU is measured by the ratio:

$$\theta_i = \frac{\mathbf{u}_i \mathbf{y}_i}{\mathbf{y}_i \mathbf{x}_i} \in [0, 1]$$

where $\mathbf{u}_i, \mathbf{v}_i \geq \mathbf{0}$ are weight vectors corresponding to the outputs and inputs of the ith DMU. DEA provides an assessment of the relative efficiency of a DMU compared to set of other DMUs. In this relative evaluation setting, each DMU is free to specify its own combination of input-output weights that maximize its performance relative to its "competitors". Under constant returns to scale (CRS) and assuming an input orientation, the optimal efficiency for the ith DMU can be estimated through the linear programming formulation introduced by Charnes et al. (1978), which is expressed in primal and dual form as follows (CCR model):

$$\begin{array}{lll} \textit{Primal:} & & \\ \max & \mathbf{u}_i \mathbf{y}_i & \\ \text{s.t.} & \mathbf{v}_i \mathbf{X} - \mathbf{u}_i \mathbf{Y} \geq \mathbf{0} & \\ & \mathbf{v}_i \mathbf{x}_i = 1 & \\ & \mathbf{u}_i, \mathbf{v}_i \geq \mathbf{0} & \end{array} \qquad \begin{array}{lll} \textit{Dual:} & & \\ \min & \theta_i^C & \\ \text{s.t.} & \theta_i^C \mathbf{x}_i - \mathbf{X}\boldsymbol{\lambda} \geq \mathbf{0} & \\ & \mathbf{Y}\boldsymbol{\lambda} \geq \mathbf{y}_i & \\ & \boldsymbol{\lambda} \geq \mathbf{0}, \;\; \theta_i^C \in \mathbb{R} & \end{array} \tag{1}$$

The estimate θ_i^C obtained from the CCR model provides a global technical efficiency measure without taking into consideration any scale effects. In that sense, it is assumed that all DMUs are operating at an

[2] Lozano-Vivas et al. (2002) discuss this issue in the context of bank efficiency analysis and present a DEA-based approach that enables cross-country comparisons through the consideration of environmental variables.

optimal scale (Coelli et al., 2005). To take into account cases where this assumption is not true, variable returns to scale (VRS) can be introduced by simply adding the convexity constraint $\lambda_1+\lambda_2+\ldots+\lambda_N=1$ to the dual CCR model. This constraint ensures that a DMU is benchmarked only against other units of similar size. The resulting model is widely known as the BCC model (Banker et al., 1984).

The combination of the results obtained from the CCR and BCC models provides a decomposition of the global efficiency as follows:

$$\theta_i^C = \theta_i^V \theta_i^S$$

where $0 \leq \theta_i^V \leq 1$ is the pure efficiency score obtained under VRS from the BCC model and $0 \leq \theta_i^S \leq 1$ is the scale efficiency factor. Thus, the inefficiency of a DMU can be attributed to inefficient operation (e.g., too small θ_i^V), disadvantageous exogenous conditions (corresponding to scale inefficiency), or both.

2.2 Multicriteria Evaluation

DEA models are useful for evaluating the relative efficiency of DMUs and discriminating between efficient and inefficient DMUs. However, the use of DEA models for evaluating and ranking all DMUs in a common basis is troublesome. An overview of different DEA-based ranking models and an empirical comparative analysis can be found in Sarkis (2000), whereas Bouyssou (1999) provides a critical discussion of the theoretical difficulties that arise when such models are used in an multicriteria evaluation context.

Multicriteria decision making (MCDM), on the other hand, provides a wide range of techniques, which are well-suited to evaluation problems where a complete ranking of a discrete set of alternatives is needed. In the context of this study, the simulation-based SMAA multicriteria framework is employed (Stochastic Multicriteria Acceptability Analysis; Lahdelma et al., 1998). SMAA provides a general context for multicriteria evaluation problems under uncertainty, but it is also applicable in deterministic problems. The basic underlying idea of SMAA is that the uncertainties involved in multicriteria evaluation problems can be taken into consideration through simulation approaches. Such simulations enable the decision-maker to obtain a holistic view of the evaluation results under different scenarios with regard to the parameters of the decision model and/or the evaluation data. SMAA can be used with any multicriteria evaluation model and for different types of decision problems (e.g., choice, ranking, classification, or description). An overview of the SMAA modeling framework, its extensions, and applications can be found in Tervonen and Figueira (2008).

Simulation approaches for multicriteria performance evaluation problems are particularly useful when specific preferential information on the relative importance of the evaluation criteria and their aggregation is not available for a given decision-maker or a group of decision-makers. In such cases, it is helpful to perform a comprehensive evaluation of the alternatives' performance under different scenarios with respect to the parameters of the evaluation model. Thus, the evaluation takes into account different settings and hypotheses with respect to the judgment policy of a "hypothetical" decision-maker.

In contrast to DEA-based efficiency analysis, MCDM evaluation models do not distinguish inputs and outputs. Instead, each alternative (i.e., a DMU in the context of DEA) is described over a set of N evaluation criteria, which enable the comparison of all alternatives on a common basis. In this study, the aggregation of the criteria is performed through an additive value function model:

$$V(\mathbf{x}) = \sum_{j=1}^{N} w_j v_j(x_{ij}) \tag{2}$$

where $\mathbf{x}_i = (x_{i1}, \ldots, x_{iN})$ is the vector with the data for bank i on the evaluation criteria, $w_1, \ldots, w_N$ are non-negative trade-off constants for the criteria that sum up to 1, and $v_j(\cdot)$ are the marginal value function criterion j normalized in [0, 1]. On the basis of such an additive model, the alternatives under consideration can be ranked from the best to the worst according to their global value score (in descending, i.e., the best alternatives are those with the highest global value).

The marginal value functions provide a decomposition of the overall performance of an alternative on the set of criteria and can have any monotone form (e.g., non-decreasing for maximization criteria). In order to avoid posing restrictions on the form of the marginal value functions, we employ a piecewise linear modeling approach. In particular, the scale of each criterion j (assumed to be in maximization form) is divided into s_j subintervals defined by breakpoints $b_0^j < b_1^j < \cdots < b_{s_j-1}^j < b_{s_j}^j$, where b_0^j and $b_{s_j}^j$ are the least and most preferred levels of the criterion. Then, for any $b_{\ell-1}^j \leq x_{ij} \leq b_\ell^j$ (for some $\ell \in \{1, \ldots, s_j\}$), the corresponding marginal value (partial score) of bank i on criterion j can be obtained

by linear interpolation as follows:

$$v_j(x_{ij}) = v_j(b^j_{\ell-1}) + [v_j(b^j_\ell) - v_j(b^j_{\ell-1})]\frac{x_{ij} - b^j_{\ell-1}}{b^j_\ell - b^j_{\ell-1}}$$

In a typical MCDM setting, the parameters (i.e., the criteria trade-offs and the associated marginal value functions) of the evaluation model (2) are specified by the decision-maker. As noted above, when a decision-maker is not available (as in this study), a simulation-scenario analysis approach can be helpful. Thus, through the SMAA framework, a Monte Carlo simulation approach is employed in order to perform the evaluation of the banks under different scenarios with respect to the criteria aggregation model. In particular, each scenario r involves the construction of a random additive value function $V_r(\mathbf{x}) = w_{1r}v_{1r}(x_1) + \ldots + w_{Nr}v_{Nr}(x_N)$ through the following two-step process:

1. For each criterion j, a random marginal value function is first constructed by generating $s_j - 1$ uniformly distributed random numbers in (0, 1), which are sorted and then assigned to $v_{jr}(b^j_1)$, $v_{jr}(b^j_2)$, ..., $v_{jr}(b^j_{s_j-1})$. For normalization, $v_{jr}(b^j_0)$ and $v_{jr}(b^j_{s_j})$ are set equal to 0 and 1, respectively. In all simulations, four subintervals are used for the criteria (i.e., $s_j = 4$, for all j) defined on the basis of the 25%, 50%, and the 75% percentile of the data.

2. Random trade-off constants $w_1, \ldots, w_N \geq \varepsilon$ are generated, such that $w_1 + \cdots + w_n = 1$. The constant ε is set equal to 0.01 in order to exclude unrealistic scenarios, where a criterion becomes almost irrelevant for the evaluation.

The resulting additive value model $V_r(\mathbf{x})$ is used to evaluate and rank the banks according to their global values. The results of all simulation runs can be aggregated to obtain an overall evaluation score for each bank. In this study, this overall score for each bank i is simply the average score of the bank across all evaluation scenarios:

$$V(\mathbf{x}_i) = \frac{1}{R}\sum_{r=1}^{R} V_r(\mathbf{x}_i)$$

where R is the number of scenarios explored through the simulation process.

3 Empirical Results

3.1 Data and Variables

The sample used in the analysis consists of 4,386 bank-year observations during the period 2005–2010, obtained through the Bankscope database. The cooperative banks in the sample originate from Germany, France, Italy, Spain, and Austria. In all these countries, cooperative banks are well-developed and constitute an important part of the banking sector. Details on the number of banks in the sample are shown in Table 1.

Table 1: Number of banks in the sample

	2005	2006	2007	2008	2009	2010	Total
Germany	242	246	247	248	245	243	1,471
France	66	63	66	75	74	73	417
Italy	234	239	243	245	247	243	1,451
Spain	79	79	69	79	79	77	462
Austria	108	114	111	89	84	79	585
Total	729	741	736	736	729	715	4,386

Different approaches have been suggested in the existing literature on bank efficiency evaluation with regard to the specification of the input and output variables. In particular, production, intermediation, and profit-approaches have been employed (Pasiouras, 2008). Berger and Humphrey (1997) argue that a production approach is more suitable for evaluating the efficiency of bank branches, whereas the intermediation approach is better suited when the analysis involves entire banking institutions. On the other hand, Berger and Mester (2003) as well as Drake et al. (2006) note that the profit approach captures

the diversity of strategic decisions taken by financial firms in a dynamic context. In this study, both the intermediation and the profit approaches are employed. The input and output variables used in each setting are listed in Table 2.

Table 2: Input and output variables

	Profit approach	Intermediation approach
Inputs	Loan loss provisions (LLP)	Dep. & short-term funding (DSTF)
	Personnel expenses (PE)	Fixed assets (FA)
	Other operating expenses (OE)	Loan loss provisions (LLP)
Outputs	Net interest income (NII)	Loans (L)
	Non-interest operating income (OI)	Other earning assets (OEA)

In addition to the variables used in measuring the efficiency of the banks, a set of eight financial ratios is also employed for the evaluation of their performance through the multicriteria methodology (Table 3). The ratios are selected on the basis of data availability and their relevance to bank performance evaluation according to the existing literature. The selected ratios cover all major aspects of a bank's performance, including profitability, capital structure, liquidity, and solvency.

Table 3: Financial ratios for performance evaluation

Net interest margin (NIM)
Cost to income ratio (CIR)
Loan loss provisions / Net interest income (LLP/NII)
Equity / Total assets (E/A)
Non interest expenses / Total assets (IE/A)
Return on assets (ROA)
Net loans / Total assets (L/A)
Liquid assets / Deposits & short-term funding (LA/DSTF)

Tables 4 and 5 present some summary statistics (averages) for the input and output variables as well as for the selected financial ratios, over the period of the analysis and across the different countries in the sample. The effect of the recent crisis is clearly evident in the sharp increase of loan loss provisions in 2008 and 2009 (increase by more than 150% in 2009 compared to 2007) and the decline in ROA (by more than 45% in 2010 compared to 2007). As far as the differences between the countries are concerned, the cooperative banks from France are on average much larger than those from other countries. Furthermore, banks from France, Italy, and Spain are on average more profitable (i.e., higher ROA), have lower loan loss provisions to net interest income, and they are more leveraged (high loan/assets ratio). German and Austrian banks depict common characteristics, with the only exception being the higher liquidity of Austrian banks (LA/DSTF ratio).

3.2 Efficiency Analysis Results

In order to analyze the efficiency of the cooperative banks in the sample, the DEA input oriented models (CCR and BCC) are employed. Five panel data sets are used, one for each country covering all years in the examined time period. In this way, the differences between the country characteristics are controlled and the bias from the consideration of all countries in a common sample is eliminated. Tables 6 and 7 summarize the efficiency results across all countries and years, for both the profit and the intermediation approach.

The comparison between the profit and the intermediation approaches indicates considerable differences. Overall, the CCR efficiency under the profit-based approach is about 23% lower than the intermediation approach, whereas the overall average BCC and scale efficiency scores are lower by about 18% and 7% respectively. Furthermore, different efficiency patterns among countries are also observed. In particular, Austria is the only country where the efficiency is higher under the profit approach (by 4.6–16% for CCR efficiency and 2.4–9.4% for BCC efficiency), although the differences have reduced in 2009 and 2010. This indicates that Austrian cooperative banks are more efficient in managing their expenses and generating profits than when evaluated in terms of their ability to produce loans by exploiting

Table 4: Averages of input/output variables and financial ratios by year

		2005	2006	2007	2008	2009	2010
Inputs & outputs*	FA	48.20	55.46	57.99	60.82	58.50	61.28
	DSTF	3724.12	4362.87	4593.33	5300.42	5160.37	5697.89
	LLP	10.57	12.71	14.68	30.62	38.84	29.93
	PE	57.81	65.67	67.18	74.00	69.21	74.36
	OE	44.26	50.74	48.86	62.32	53.15	56.33
	L	2917.73	3551.25	3884.34	4466.18	4364.40	4800.14
	OEA	3348.51	4357.63	4512.64	5674.39	4778.00	4936.79
	NII	94.01	104.22	97.63	121.56	129.79	133.95
	OI	64.76	83.23	77.06	55.38	61.21	72.61
Ratios	NIM	2.62	2.66	2.66	2.60	2.40	2.26
	CIR	67.92	63.68	64.26	66.27	66.07	67.29
	LLP/NII	15.01	17.60	14.73	18.85	19.67	19.11
	E/A	8.86	9.01	8.95	8.52	8.64	8.61
	IE/A	2.37	2.28	2.17	2.08	2.03	1.99
	ROA	0.58	0.61	0.62	0.44	0.33	0.32
	L/A	63.81	64.10	64.62	64.57	64.23	65.37
	LA/DSTF	21.06	20.91	21.24	20.92	18.68	16.26

* In thousand euros

Table 5: Averages of input/output variables and financial ratios by country

		Germany	France	Italy	Spain	Austria
Inputs & outputs*	FA	3320.79	70080.28	2463.35	2748.44	2646.11
	DSTF	26.00	300.23	36.99	37.07	27.20
	LLP	2074.37	34091.80	1334.32	1947.34	1644.47
	PE	75.50	1600.80	44.71	55.59	82.72
	OE	22.84	476.27	31.31	21.50	18.40
	L	18.33	372.29	21.45	15.27	17.65
	OEA	1392.56	26658.93	1762.97	2184.62	1342.97
	NII	1827.14	38114.73	506.48	421.24	1144.62
	OI	43.39	732.95	55.56	57.31	35.74
Ratios	NIM	2.43	1.83	2.92	2.57	2.32
	CIR	69.08	60.89	65.62	59.67	67.13
	LLP/NII	19.89	16.50	14.83	16.80	19.27
	E/A	6.15	10.48	11.10	9.81	7.51
	IE/A	2.23	1.88	2.31	1.73	2.11
	ROA	0.30	0.66	0.65	0.62	0.32
	L/A	57.53	69.79	71.46	70.94	55.49
	LA/DSTF	17.43	20.91	19.27	20.63	26.10

* In thousand euros

Table 6: Average efficiency scores by country and year (profit approach)

Type	Country	2005	2006	2007	2008	2009	2010	Average
CCR	Germany	0.553	0.608	0.572	0.558	0.597	0.620	*0.585*
	France	0.676	0.691	0.687	0.612	0.650	0.660	*0.661*
	Italy	0.358	0.374	0.358	0.326	0.324	0.312	*0.342*
	Spain	0.613	0.625	0.636	0.591	0.598	0.577	*0.606*
	Austria	0.676	0.687	0.702	0.702	0.680	0.664	*0.686*
	Average	*0.526*	*0.554*	*0.537*	*0.507*	*0.520*	*0.520*	*0.527*
BCC	Germany	0.606	0.657	0.626	0.613	0.641	0.659	*0.634*
	France	0.781	0.791	0.784	0.714	0.765	0.775	*0.767*
	Italy	0.518	0.532	0.511	0.479	0.465	0.449	*0.492*
	Spain	0.687	0.720	0.757	0.719	0.696	0.650	*0.704*
	Austria	0.724	0.741	0.757	0.747	0.732	0.715	*0.737*
	Average	*0.620*	*0.648*	*0.634*	*0.606*	*0.610*	*0.605*	*0.621*
Scale	Germany	0.921	0.930	0.919	0.916	0.936	0.945	*0.928*
	France	0.871	0.877	0.875	0.853	0.853	0.856	*0.863*
	Italy	0.715	0.726	0.734	0.727	0.738	0.735	*0.729*
	Spain	0.896	0.875	0.847	0.830	0.860	0.889	*0.866*
	Austria	0.941	0.936	0.935	0.944	0.935	0.936	*0.938*
	Average	*0.851*	*0.855*	*0.850*	*0.841*	*0.852*	*0.858*	*0.851*

Table 7: Average efficiency scores by country and year (intermediation approach)

Type	Country	2005	2006	2007	2008	2009	2010	*Average*
CCR	Germany	0.717	0.698	0.714	0.696	0.694	0.701	*0.703*
	France	0.762	0.801	0.801	0.782	0.786	0.780	*0.785*
	Italy	0.679	0.671	0.669	0.677	0.675	0.641	*0.669*
	Spain	0.732	0.746	0.740	0.703	0.664	0.713	*0.716*
	Austria	0.595	0.601	0.605	0.610	0.650	0.627	*0.613*
	Average	*0.693*	*0.688*	*0.693*	*0.689*	*0.688*	*0.682*	*0.689*
BCC	Germany	0.803	0.785	0.792	0.768	0.756	0.762	*0.778*
	France	0.804	0.826	0.832	0.811	0.810	0.804	*0.814*
	Italy	0.744	0.737	0.738	0.752	0.752	0.722	*0.741*
	Spain	0.765	0.785	0.763	0.742	0.726	0.769	*0.758*
	Austria	0.684	0.685	0.692	0.686	0.703	0.698	*0.691*
	Average	*0.762*	*0.758*	*0.760*	*0.754*	*0.751*	*0.746*	*0.755*
Scale	Germany	0.894	0.889	0.901	0.906	0.916	0.917	*0.904*
	France	0.951	0.969	0.965	0.967	0.971	0.972	*0.966*
	Italy	0.917	0.915	0.913	0.908	0.904	0.897	*0.909*
	Spain	0.959	0.952	0.971	0.951	0.920	0.931	*0.947*
	Austria	0.871	0.881	0.879	0.891	0.922	0.899	*0.889*
	Average	*0.910*	*0.910*	*0.914*	*0.916*	*0.918*	*0.916*	*0.914*

Table 8: Correlations between the profit and the intermediation efficiency scores

	CCR	BCC	Scale
Germany	0.343	0.398	0.276
France	0.237	0.274	0.298
Italy	0.358	0.408	0.370
Spain	0.349	0.435	0.222
Austria	0.350	0.549	0.275

their assets. On the other hand, the efficiency of Italian cooperative banks under the profit scenario is considerably lower compared to the intermediation approach (by about 50% in CCR and 33% in BCC).

Table 8 provides detailed results on the correlations between the efficiency scores obtained under the two considered variable settings. The results show, that in most cases the correlations are rather moderate, yet significant at the 1% level.

In terms of the dynamics of the efficiency results, the efficiency scores under the intermediation approach do not exhibit significant variations over time. Thus, the operation of the banks evaluated in terms of their ability to produce loans, has not been considerably affected by the recent crisis. On the other hand, the situation is different from the profit perspective. In particular, the average CCR and BCC efficiency scores under the profit-based approach declined in 2008 by about 5.6% and 4.4%, respectively, compared to 2007. In 2009 and 2010 minor improvements are observed in Germany and France. In particular, the improvement in 2010 compared to 2008 for German banks exceeds 11% under the CCR model and 7% under the BCC model. The corresponding increases for banks in France are 7.9% (CCR) and 8.5% (BCC). In all other countries, both CCR and BCC efficiency (under the profit approach) continued to decline in 2009–2010.

It is also worth noting that under both the profit and the intermediation approach, scale efficiency scores remain at almost constant levels, in most cases higher than 85% (with the exception of Italy under the profit approach). Thus, the overall (CCR) efficiency of the cooperative banks is mainly described by their internal operation as captured through the results of the BCC model. This result agrees with the finding of Bos and Kool (2006) on a sample of cooperatives in the Netherlands, who concluded that about 90% of the inefficiencies in their sample originated from managerial inefficiencies.

Finally, Figures 1 and 2 illustrate the relationship between the size of the banks and their global CCR efficiency scores under the profit and intermediation approaches. The banks in each country are classified as small, medium, and large depending on their assets. Small banks are those with assets in the first asset quartile (i.e., bottom 25%) of all banks in the same country, medium banks have assets in the interquartile range, whereas large banks are those with assets in the third quartile (top 25%). The results show that under both the profit and the intermediation approach large banks have (overall) higher efficiency scores, but generally there is no clear-cut conclusion consistent across all countries.

3.3 Multicriteria Evaluation Results

While the DEA results provide useful information about the relative efficiency of the banks, they do not enable performing direct comparisons among all banks from different countries in a common setting. The multicriteria evaluation process helps towards this direction. The application of the SMAA-2 framework in this study was implemented under 10,000 different scenarios generated through a Monte Carlo simulation process. As described in section 2.2 each scenario corresponds to a different additive evaluation model based on different assumptions with respect to the priorities (trade-offs) assigned to the selected financial ratios and the form of the ratios' marginal value functions.

The application of the multicriteria evaluation process is based on the full panel data sample consisting of all bank-year observations from all countries. The average global scores (values) of the banks across all years and countries are summarized in Table 9. Overall, banks from Spain and Italy performed best (on average), while German banks had the lowest performance. Nevertheless, when examining the variations over the time period of the analysis, it is clearly evident that German banks were the only ones that managed to respond to the crisis in a satisfactory way. In particular, over the period 2005–2008, the performance of German banks remained almost unchanged, whereas in 2009–2010 they improved their performance by more than 12% overall (2010 vs 2008). The performance of the banks in all other countries declined in 2008 by 6.4% (Austria) up to 10.3% (France) compared to 2007. French banks rebounded in 2009–2010 achieving an improvement of 2.6% in 2009 compared to 2008, followed by an additional

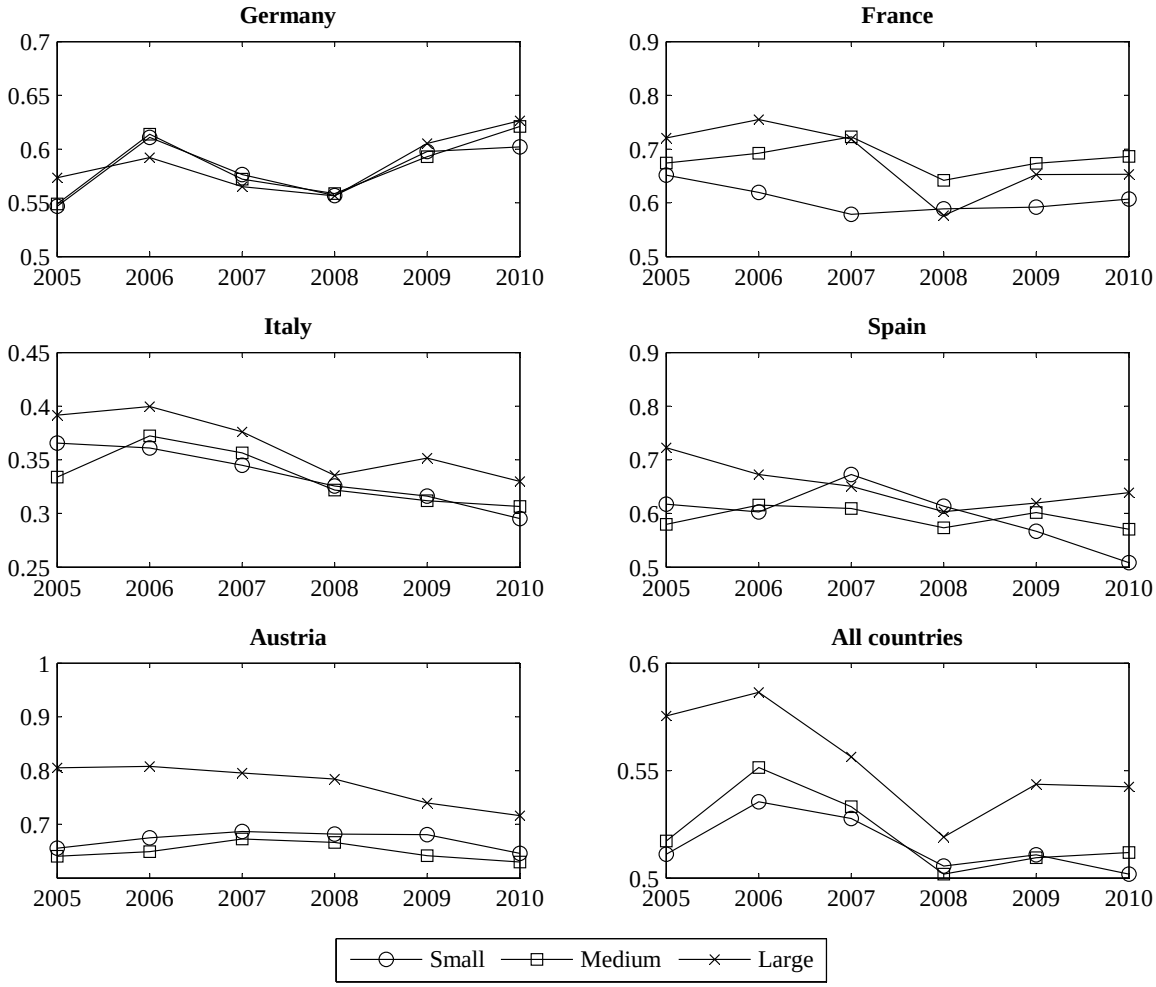

Figure 1: CCR efficiency scores by country and asset size (profit-based approach)

improvement of 6.5% in 2010. The performance of Austrian banks continued to decline in 2009–2010 but at a reduced rate (−4.9% in 2009 vs 2008, and −1.7% in 2010 vs 2009). On the other hand, Italian and Spanish banks continued their decline, with the overall decrease in 2010 compared to 2008 exceeding 23% in the case of Italy and 15% in the case of Spain. Overall, the multicriteria evaluation results seem to better fit (as opposed to the DEA efficiency results) the tough conditions prevailing in the European banking sector due to the ongoing economic turmoil.

Table 9: Average multicriteria evaluation results by country and year

Country	2005	2006	2007	2008	2009	2010	*Average*
Germany	0.437	0.436	0.432	0.429	0.459	0.483	*0.446*
France	0.550	0.556	0.524	0.469	0.482	0.513	*0.514*
Italy	0.546	0.589	0.600	0.561	0.486	0.431	*0.535*
Spain	0.569	0.590	0.600	0.561	0.530	0.473	*0.553*
Austria	0.506	0.528	0.537	0.503	0.478	0.470	*0.507*
Average	*0.507*	*0.526*	*0.527*	*0.500*	*0.480*	*0.466*	

The results of the multicriteria evaluation process can also be used to get insight on the relationship between the criteria weighting scenarios explored through the simulation process and the performance of the banks. This provides an indication of the strengths and weaknesses of the banks. To perform this analysis, for each criterion j the simulation scenarios in which the criterion is assigned the highest and lowest priority (i.e., the highest/lowest weight among all criteria) are identified. Let the corresponding scenarios be denoted by H_j^+ (highest weight) and H_j^- (lowest weight). Then, we calculate the percentage

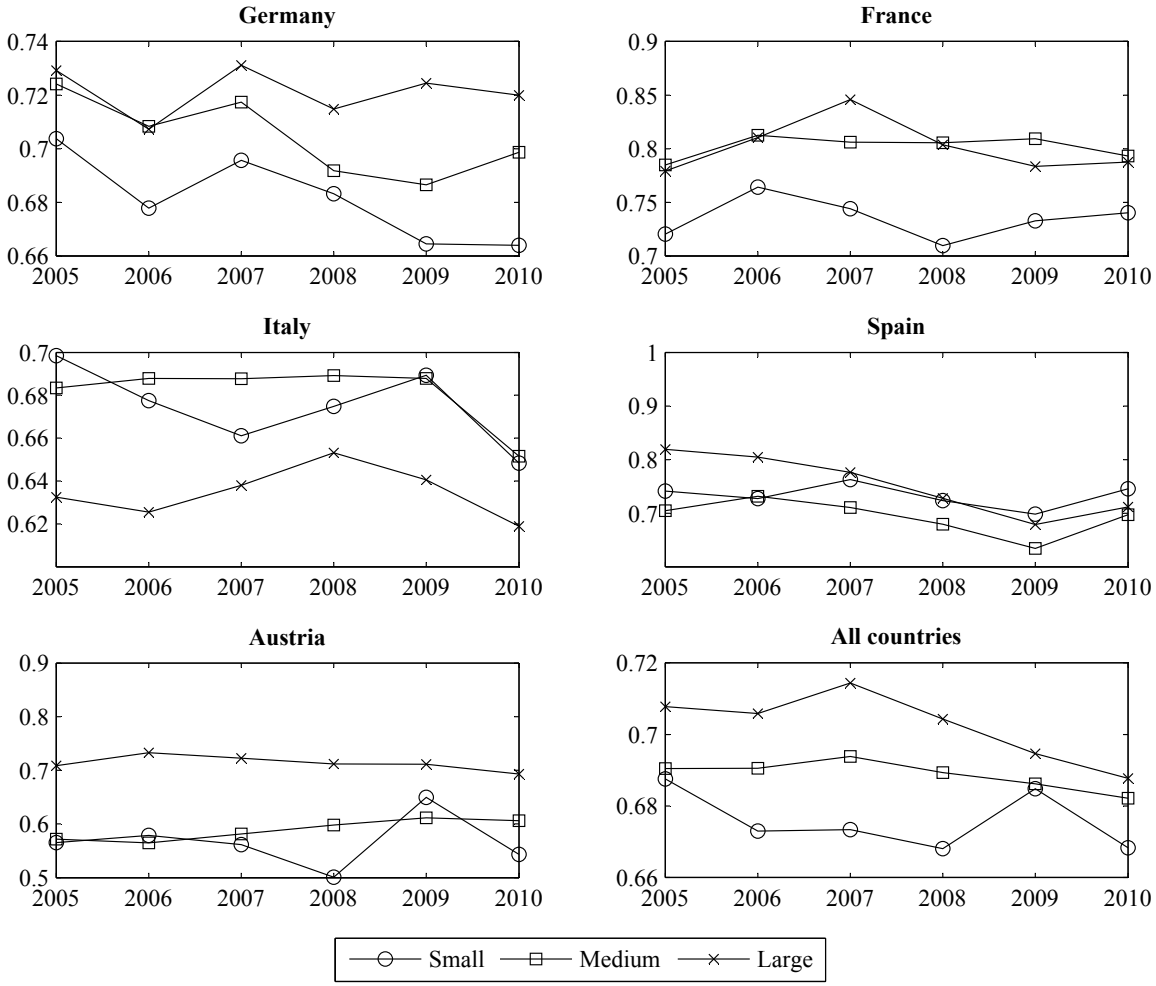

Figure 2: CCR efficiency scores by country and asset size (intermediation approach)

change between the average performance of the banks under scenarios H_j^+ compared to the average performance under scenarios H_j^-. Table 10 presents the obtained results for all countries. According to the results, the performance of German banks is much improved when loan/assets is considered as the most important ratio. The improvement is 15.62% compared to the scenarios where loan/assets is considered as the least important ratio. On the other hand, the performance of German banks deteriorates when equity/assets is given top priority. A similar result is also obtained for the ROA ratio. Thus, the low loan/assets ratio is a strength of German banks, whereas the low equity/assets and ROA ratios are their most important financial weaknesses. Following the same line of reasoning, the strengths and weaknesses of the banks in the other countries are also identified. In Table 10 these are marked with (+) for strengths and (−) for weaknesses. Overall, it is worth noting that loan/assets is the only ratio which has significant impact (positive or negative) in all countries. The earning/assets and ROA ratios are also strong determinants of the performance of the banks in all countries except Spain.

Figure 3 provides some additional results on the performance of the banks in terms of their size. In contrast to the indications derived on the basis of the DEA results, the multicriteria evaluation of the banks suggest that generally small banks seem to have performed slightly better than larger banks. Again, however, this conclusion depends on the country under consideration. For instance, large banks in France have consistency outperformed smaller ones banks, whereas the differences in Germany are limited and mixed.

Finally, it is worth analyzing the relationship between the efficiency analysis results obtained with DEA and the multicriteria evaluation of the banks. To this end, Figure 4 compares the global scores of the banks obtained through the MCDM approach with the CCR and BCC efficiency classifications obtained from the DEA models under the profit and the intermediation approaches. It is clearly evident that the multicriteria scores for the efficient banks are in all cases higher compared to the inefficient ones. All differences are significant at the 1% level according to the non-parametric Mann-Whitney test.

Table 10: Performance changes (in %) with respect to the criteria's priorities

	Germany	France	Italy	Spain	Austria
NIM	2.49	−14.75 (–)	5.24 (+)	−2.80	−4.70
CIR	−2.12	6.08 (+)	−1.59	4.61	−2.09
LLP/NII	0.80	1.04	2.87	−1.51	−0.41
E/A	−10.89 (–)	8.06 (+)	9.82 (+)	2.80	−5.62 (–)
IE/A	1.68	9.69 (+)	−4.81	9.64 (+)	3.20
ROA	−7.30 (–)	7.86 (+)	5.22 (+)	3.53	−6.45 (–)
L/A	15.62 (+)	−9.68 (–)	−10.30 (–)	−10.88 (–)	9.07 (+)
LA/DSTF	0.86	−6.45 (–)	−5.02 (–)	−4.37	7.68 (+)

The strengths of the banks are indicated by (+) and the weaknesses by (–).

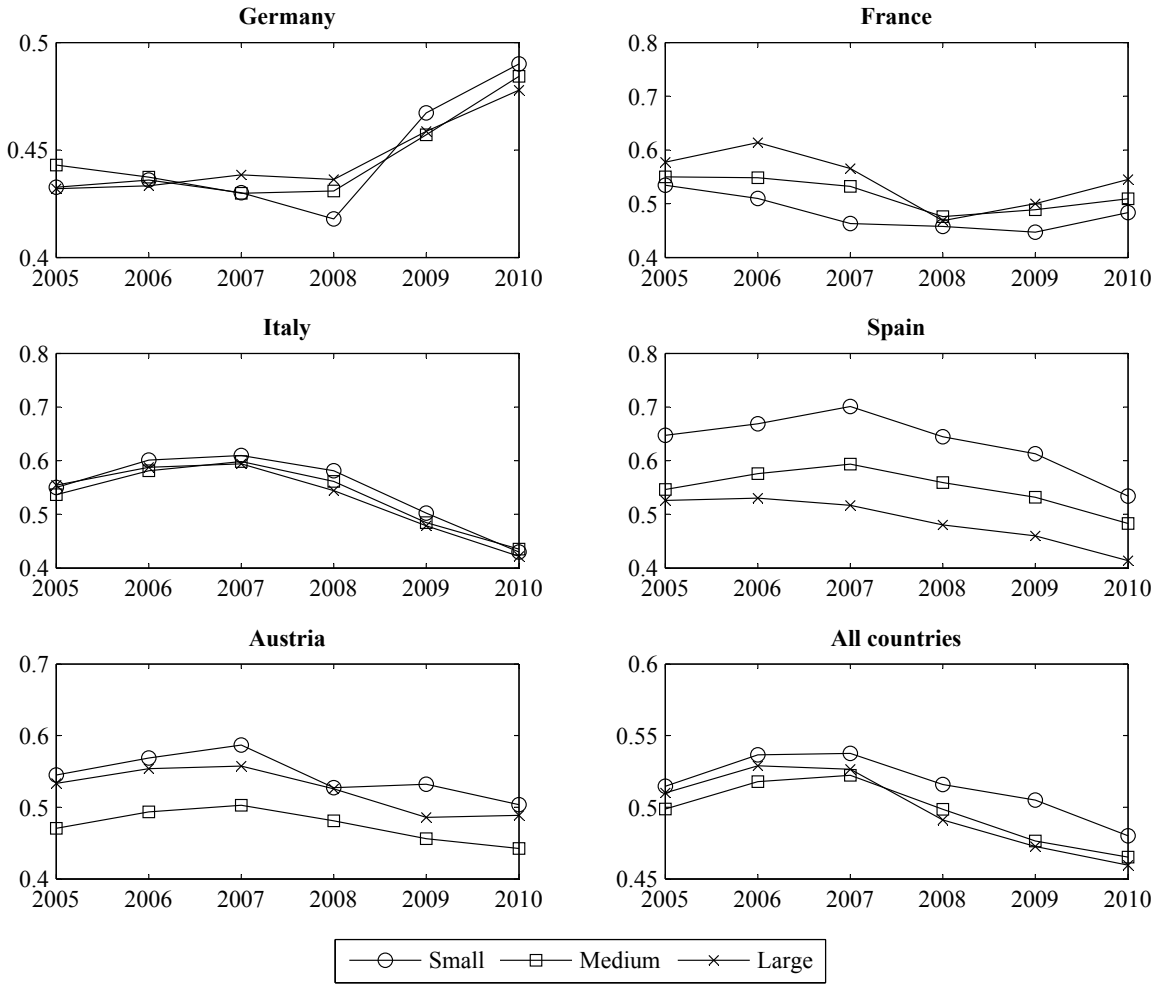

Figure 3: Multicriteria evaluation scores by country and asset size

Table 11 presents additional details on the relationship (correlation) of the multicriteria evaluation results with the DEA efficiency scores for each country. Given that the efficiency results are obtained from different samples (i.e., one for each country), we also report at the last line of the table the correlations between the multicriteria results and the efficiency estimates obtained from the full sample of all countries. It is clearly evident that the multicriteria evaluation scores of the banks are positively correlated with the efficiency scores obtain from the profit-based DEA models. The correlations for all countries are significant at the 1% level. On the other hand, the correlations when the intermediation approach is employed are much weaker. In fact, for Germany and France the correlations are negative but insignificant at the 10% level. For the rest of the countries the correlations remain statistically significant at the 1%, but they are much lower compared the ones observed with the results of the profit-based approach. Similar results

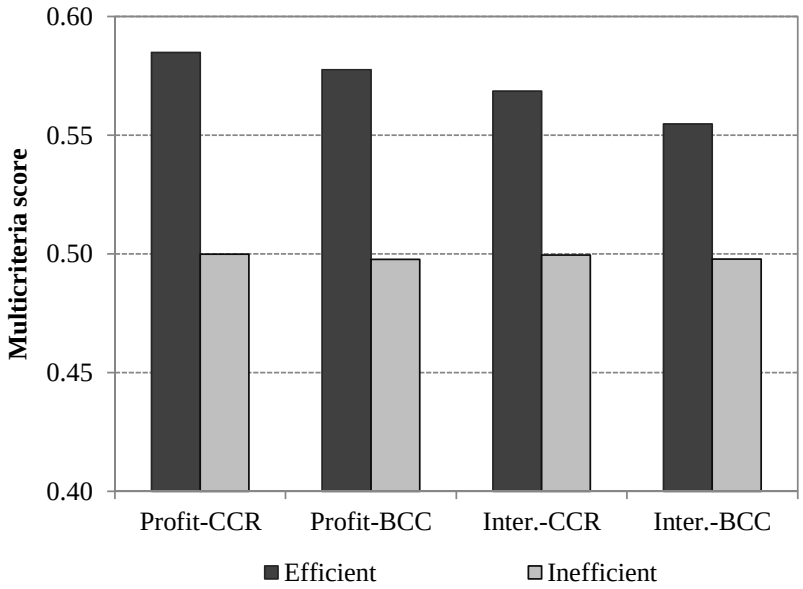

Figure 4: Average multicriteria evaluation scores of efficient vs inefficient banks

are obtained even if the multicriteria results are compared to efficiency estimates obtained from the full sample, ignoring the differences between the countries.

Table 11: Correlations between the multicriteria evaluation results and the efficiency scores

	Profit		Intermediation	
	CCR	BCC	CCR	BCC
Germany	0.473	0.477	-0.006^*	-0.009^*
France	0.498	0.476	-0.003^*	-0.053^*
Italy	0.392	0.308	0.218	0.138
Spain	0.379	0.413	0.131	0.143
Austria	0.455	0.516	0.229	0.295
Full sample	0.401	0.305	0.312	0.249

All correlations are significant at the 1% level except those marked with an asterisk

4 Conclusions

In this paper an integrated analysis of a large sample of cooperative banks from five major European countries was presented, using the most recent data available covering the period 2005–2010. The analysis covered both the efficiency of the banks as well as the evaluation of their overall performance.

In the first stage of the analysis, DEA was employed for efficiency measurement, under both a profit and an intermediation approach. The results of the two approaches were found to be rather weakly related. Overall, the profit efficiency scores were more affected by the recent crisis, whereas the results derived through the intermediation approach were much more stable.

However, the efficiency results of DEA do not allow direct comparisons between different countries and they do not provide direct indications on the overall financial performance of the banks. To address these issues a multicriteria evaluation process was also employed. The results show that cooperative banks from Italy and Spain achieved strong performance during the period 2005–2007, but (as expected) they were the ones most affected by the crisis. German banks on the other hand, were the ones least affected by the crisis and furthermore they managed to improve their performance in 2009–2010. The results of the multicriteria process also highlight the importance the loan/assets, equity/assets and ROA ratios as strong descriptors of the performance of the banks.

Future research can focus on a number of issues. Among others these may include: (1) the comparative

analysis of cooperative banks as opposed to commercial banks in the face of the new conditions formed due to the ongoing economic turmoil, (2) the development of early warning systems for cooperative banks, (3) the analysis of the specific country characteristics that affect the context in which cooperative banks operate in each country, (4) the re-examination (within the framework of the recent crisis) of the role of cooperative banks in the operation and stability of the European banking sector, and (5) the analysis of the effectiveness and the impact of the transformations imposed on the capital requirements' regulatory framework on the viability and performance of cooperative banks.

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